REMARKS

Claims 1, 3, 5-7, 9-13, 15, 17-19 and 21-28 are pending in the application.

Claims 1, 7, 11-13, 18, 19 and 23-28 have been amended. The amendments to these claims address the objections and are not intended to narrow the scope of the claimed invention. Based on these amendments, the Examiner is requested to withdraw the claim objections.

In addition, in claims 11, 23 and 27, the position of the y-axis title angle detector limitation in the claims has been changed.

Prior Art Rejections

Claims 1, 3, 5-7, 9-13, 15, 17-19 and 21-28 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Hansen et al. Applicants traverse these rejections because the cited reference fails to disclose or suggest at least the order of matrices in the claims. As mentioned in the Remarks filed with the amendment on June 8, 2005, the order of the matrices is an important distinguishing feature for the reasons discussed below.

The azimuth indicates the angle between the x-axis in the observation coordinate system of the electric compass and the reference direction (0 degree). The coordinate transformation equation indicates how the absolute coordinate system is rotated according to the attitude of the electric compass.

The coordinate transformation equation according to Hansen is "$A_{roll,}*A_{elevatioon}*A_{azimuth}$" (see col. 7, line 55). On the other hand, the coordinate transformation equation according to the claimed invention is "$A_{azimuth}*A_{elevation}*A_{roll,}$". In the following explanation, "elevation" is abbreviated to "el", and "azimuth" is abbreviated to "az".

The conversion result obtained by the equation "$A_{roll}*A_{el}*A_{az}$ is different from that obtained by the equation "$A_{az}*A_{el}*A_{roll}$ ", because a different order of the matrices generally produces different results ($A*B \neq B*A$).

For example, a unit vector on the X-axis is rotated by Hansen's equation as follows (assume that the roll is 30 degrees, the el is 45 degrees, and the az is 60 degrees):

$$Aroll * Ael * Aaz * \begin{bmatrix}1\\0\\0\end{bmatrix} = \begin{bmatrix}1 & 0 & 0\\ 0 & \sqrt{3}/2 & 1/2\\ 0 & -1/2 & \sqrt{3}/2\end{bmatrix} * \begin{bmatrix}1/\sqrt{2} & 0 & -1/\sqrt{2}\\ 0 & 1 & 0\\ 1/\sqrt{2} & 0 & 1/\sqrt{2}\end{bmatrix} * \begin{bmatrix}1/2 & \sqrt{3}/2 & 0\\ -\sqrt{3}/2 & 1/2 & 0\\ 0 & 0 & 1\end{bmatrix} * \begin{bmatrix}1\\0\\0\end{bmatrix} = \begin{bmatrix}0.35\\-0.93\\-0.13\end{bmatrix}$$

On the other hand, the azimuth is calculated as follows:

Azimuth = arctan (-0.93/0.35)/π*180(degrees)=69.3(degrees).

Thus, Hansen's equation causes an error of about 10 degrees (=69.3-60). In other words, az and the azimuth are not identical in Hansen, because Hansen first performs the rotation around the Z-axis by az, and then obtains the azimuth using the rotation matrices for rotations around the Y-axis and the X-axis.

On the other hand, according to the present invention, the unit vector on the X-axis is rotated as follows:

$$Aaz * Ael * Aroll * \begin{bmatrix}1\\0\\0\end{bmatrix} = \begin{bmatrix}1/2 & \sqrt{3}/2 & 0\\ -\sqrt{3}/2 & 1/2 & 0\\ 0 & 0 & 1\end{bmatrix} * \begin{bmatrix}1/\sqrt{2} & 0 & -1/\sqrt{2}\\ 0 & 1 & 0\\ 1/\sqrt{2} & 0 & 1/\sqrt{2}\end{bmatrix} * \begin{bmatrix}1 & 0 & 0\\ 0 & \sqrt{3}/2 & 1/2\\ 0 & -1/2 & \sqrt{3}/2\end{bmatrix} * \begin{bmatrix}1\\0\\0\end{bmatrix} = \begin{bmatrix}0.35\\-0.61\\0.71\end{bmatrix}$$

The azimuth is calculated as follows:

Azimuth=arctan (-0.61/0.35)/π180(degrees)=60.2(degrees)

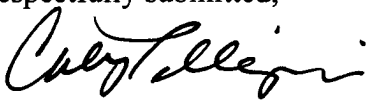
Thus, although an error of 0.2 degrees with respect to the actual azimuth is included, almost the exact azimuth can be obtained by the claimed invention.

As explained above, according to the claimed invention, it is possible to match the Z-axis rotation angle (that is, az) with the azimuth by first performing the rotation around the X-axis by roll. As a result, an exact azimuth can be obtained.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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